

TITLE OF THE INVENTION  
AUTOMATIC MANHOUR SETTING SYSTEM AND METHOD,  
DISTRIBUTED CLIENT/SERVER SYSTEM, AND  
COMPUTER PROGRAM STORAGE MEDIUM

5

FIELD OF THE INVENTION

The present invention relates to an automatic manhour setting method and system for automatically setting manhours for an enormous number of work standards representing works  
10 in, e.g., an assembly workshop, a distributed client/server system, and a computer program storage medium.

BACKGROUND OF THE INVENTION

To assembly a product from parts, an enormous number  
15 of parts are required. The larger the number of parts becomes, the more enormous and complex the works become.

Conventionally, an experienced chief of the workshop, who knows the enormous number of complex works well, manually arranges the works, calculates the manhour, and assigns  
20 operators in units of manhours.

However, this manual composing operation accompanies poor maintenance because it is not only time-consuming but also difficult to correct and can be understood only by the creator.

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## SUMMARY OF THE INVENTION

The present invention has been made to solve the above problem, and has as its object to propose automatic manhour setting system and method capable of automatically giving  
5 manhours to an enormous number of work standards, a distributed client/server system, and a computer program storage medium.

In order to achieve the above object, an automatic manhour setting system according to the present invention  
10 is characterized by having the following arrangement.

More specifically, there is provided an automatic manhour setting system (2801) for giving manhour data to work standard data converted into computer data, characterized by comprising:

15 a standard manhour database (2805) designed to be readable, in which a number of pairs each constituted by a work standard described by a standardized standard expression and a manhour corresponding to the work standard are registered in advance;

20 setting means for, for each of target work standards to which manhours are to be given, matching an expression of the target work standard with the standard expressions of the work standards in the standard manhour database and setting a standard manhour of a matching work standard in  
25 the database as a manhour of the target work standard; and  
manhour file means for storing a set manhour file.

According to a standard manhour setting system of a preferred aspect of the present invention, the target work standard to which the manhour is to be given is described by an operation phrase representing an operation of a work,  
5 an object phrase representing a target of the operation, and a comment phrase representing auxiliary information related to the operation and/or object, and each of the work standards in the database is also described by an operation phrase, object phrase, and comment phrase. This is because a work  
10 is most simply and exactly expressed by an operation phrase, object phrase, and comment phrase.

According to still another preferred aspect of the present invention, for the target work standard to which the manhour is to be given, a first comment related to an object  
15 of an operation, an object phrase representing the object of the operation, a second comment related to the operation, and an operation phrase representing the operation of the work are described in a predetermined order, and for each of the work standards in the database, a first comment, object  
20 phrase, second comment, and operation phrase are also described in the predetermined order.

There are various kinds of searching methods. If complete matching is used, for example, preferably, search based on complete matching between the expression of the  
25 target work standard and the standard expression of the work standard in the standard manhour database is preferentially

executed.

The search based on complete matching is not always successful. Hence, search based on partial matching is preferably used for the target work standard for which the search based on complete matching to the standard expression of the work standard in the standard manhour database fails.

According to still another preferred aspect of the present invention, when the search of the expression of the target work standard in the standard manhour database fails, the setting means executes search in a second manhour database whose degree of standardization is lower than that of the standard manhour database.

The standard manhour database includes work standards recognized as standards, while the second manhour database whose degree of standardization is lower includes, e.g., work standards which are barely used in the past.

The search efficiency can be increased using a wild card symbol. Hence, the expression included in the target work standard preferably includes an expression by a wild card.

Assume that the wild card symbol is used for the search, as described above. In this case, when a plurality of standard work standards which match a work standard including an expression including a wild card symbol are present, candidates are preferably displayed in a descending order of the degrees of matching to cause the user to select one

candidate.

According to still another preferred aspect of the present invention, the system is characterized in that standard manhour data in the standard manhour database  
5 contains a manhour value and data related to a set condition when the manhour value is set.

For the "set condition" the system is characterized in that the condition data is referred to by a directory in a memory space of the automatic manhour setting system, and  
10 the setting means sets a directory value of the searched set condition data of the work standard as the manhour of the target work standard.

According to still another preferred aspect of the present invention, the system comprises analysis means for  
15 analyzing the work standard to assign the manhour when no matching is obtained by searching the second manhour database.

A system having no second manhour database preferably comprises analysis means for analyzing the work standard to  
20 assign the manhour when no matching is obtained by searching the standard manhour database.

According to still another preferred aspect of the present invention, the analysis means uses a creation tool with the same reference as that in creating contents of the  
25 standard manhour database. When the tools are united, the user interfaces are also united, and the output forms are

also united.

The analysis means may use a creation tool with the same reference as that in creating contents of the second manhour database.

5       According to still another preferred aspect of the present invention, the system comprises download means for downloading a plurality of work standard data to which manhours are to be given.

10       For the download user interface, the standard manhour setting system is characterized in that

the plurality of downloadable work standard are stored in an external database, and

the download means comprises

15       means for downloading directories of the downloadable work standards from the external database and displaying the directories, and

selection means for selecting an arbitrary one of the displayed directories, thereby selecting the target work standard to which the manhour is to be given.

20       The system is characterized in that the external database stores the downloadable work standards having a hierarchical structure according to the degree of assembly,

the download means downloads upper directories to the manhour setting system together with the directories of the  
25       downloadable work standards,

the display means displays the downloaded work

standard directories and upper directories together, and

the selection means can designate whether one of the  
displayed work standard directories or upper directories is  
selected. With this arrangement, the user can select a  
5 plurality of work standards at once in accordance with a  
composition revision watchdog according to the his/her  
purpose.

The above object can also be achieved by a distributed  
client/server database system comprising a server including  
10 the above-described storage means and a plurality of clients  
each having input means.

The above object can also be achieved by a work standard  
creation method corresponding to each of the above-described  
system configurations or a computer program storage medium  
15 for realizing the method by a computer system.

Other features and advantages of the present invention  
will be apparent from the following description taken in  
conjunction with the accompanying drawings, in which like  
reference characters designate the same or similar parts  
20 throughout the figures thereof.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a view showing the hardware configuration  
of an assembly standard information management system  
25 according to an embodiment;

Fig. 2 is a view showing the relation structure of a

representative model record, process (arrangement) record,  
and work standard record;

Fig. 3 is a view for explaining a window in which work  
standard data is to be input in the work standard system;

5 Fig. 4 is a view showing the linkage between master  
data files in the work standard system;

Fig. 5 is a flow chart for explaining the procedure  
of inputting work standard data;

Fig. 6 is a view for explaining a window for inputting  
10 data to the "applied model" field;

Fig. 7 is a view for explaining another method of  
inputting a model name to an applied model field 302;

Fig. 8 is a view for explaining reference input of data  
related to a part;

15 Fig. 9 is a view for explaining incremental search  
input of data related to a work;

Fig. 10 is a view for explaining incremental search  
input of data related to a work;

Fig. 11 is a view for explaining a window in which data  
20 related to a work is to be input;

Fig. 12 is a view for explaining reference input in  
inputting work data;

Fig. 13 is a view for explaining the reference input  
function in inputting "verb" in the work procedure;

25 Fig. 14 is a flow chart showing the control procedure  
in inputting data on the basis of the work procedure input

window shown in Fig. 11;

Fig. 15 is a view for explaining an example of a plurality of input work procedures;

Fig. 16 is an explanatory view of the reference input  
5 function in inputting a note;

Fig. 17 is an explanatory view of the reference input function in inputting a note;

Fig. 18 is an explanatory view of various menus for editing the work procedure itself;

10 Fig. 19 is a view for explaining operation of exchanging two work procedures;

Fig. 20 is a view for explaining operation of exchanging two work procedures;

Fig. 21 is an explanatory view of a menu for storing  
15 a created work;

Fig. 22 is a view showing a menu window for opening a work to be edited in editing the work standard;

Fig. 23 is a view for explaining a plurality of works opened by the menu shown in Fig. 22;

20 Fig. 24 is a view for explaining a menu window for executing an image editing function;

Fig. 25 is a view for explaining an input field to which an image to be attached is to be loaded;

Fig. 26 is a view showing an image attached to the work  
25 standard data;

Fig. 27 is a view showing a menu window for selecting

a tool to edit an image;

Fig. 28 is a view for explaining positioning of a translation subsystem in the work standard creation system;

Fig. 29 is a view for explaining a start menu for  
5 starting translation;

Fig. 30 is a view showing a window for selecting a work standard to be translated;

Fig. 31 is a view for explaining a state wherein the work standard to be translated and an English equivalent are  
10 displayed on opposite sides;

Fig. 32 is a view for explaining a state wherein the work standard to be translated and an English equivalent are displayed on opposite sides;

Fig. 33 is a view for explaining a menu window for  
15 activating playback of voice data attached to the work standard;

Fig. 34 is a view for explaining a menu window for activating voice data recording;

Fig. 35 is a view showing the storage positions of  
20 files in a work standard creation system 2800 and translation system 2803;

Fig. 36 is a view for explaining the file structure of a standard manhour setting system 2801 of the embodiment in the form of blocks;

Fig. 37 is a view for explaining the data structure  
25 of a manhour setting file 3601;

Fig. 38 is a view for explaining the data structure of a standard data file 2804;

Fig. 39 is a view showing the directory structure in the standard data file 2804;

5 Fig. 40 is a view for explaining three routes of manhour setting in the standard manhour setting system 2801;

Fig. 41 is a view for explaining the outline of data load in the standard manhour setting system 2801;

10 Fig. 42 is a view for explaining the first route for setting the manhour on the basis of data from a standard material data file;

Fig. 43 is a view for explaining the second route for setting the manhour on the basis of data from an operation pattern data file;

15 Fig. 44 is a view showing a manhour setting file 3601;

Fig. 45 is a view for explaining the initial menu window of the standard manhour setting system 2801;

20 Fig. 46 is a view for explaining the window structure for defining the data range to be loaded in the standard manhour setting system 2801;

Fig. 47 is a view showing the list of work data defined by the window shown in Fig. 46;

Fig. 48 is a view for explaining the data load window;

25 Fig. 49 is a view for explaining that arbitrary works can be grouped by arbitrarily changing the hierarchical structure of directories in the standard manhour setting

system 2801;

Fig. 50 is a view for explaining the file structure of the standard manhour setting system 2801;

Fig. 51 is a flow chart for explaining the control  
5 procedure of the standard manhour setting system 2801;

Fig. 52 is a view for explaining a user interface window for selecting a "product" as a manhour setting target;

Fig. 53 is a view for explaining another user interface window for selecting a "product" as a manhour setting target;

10 Fig. 54 is a view for explaining the "model" selection window;

Fig. 55 is a view for explaining the dialog for selecting a "work" to be edited;

15 Fig. 56 is a view for explaining a work loaded by selection in Fig. 55;

Fig. 57 is a view for explaining the analysis material editing window;

Fig. 58 is a view for explaining a user interface window for selecting a work to be analyzed;

20 Fig. 59 is a view for explaining a user interface window for displaying representative WFs (Work Factors) that can be selected by the user;

Fig. 60 is a view showing a user interface window so as to explain the manhour definition of PU (pick up)  
25 operation;

Fig. 61 is a view showing a user interface window so

as to explain the manhour definition of TURN (direction changing) operation;

Fig. 62 is a view for explaining a window for inquiring the change reason for the manhour of a specific work;

5 Fig. 63 is a view showing a window for displaying the change reason for the manhour;

Fig. 64 is a view for explaining the basic operation of a work assignment system 2802;

10 Fig. 65 is a view for explaining the file structure of the work assignment system 2802;

Fig. 66 is a view for schematically explaining the work composition in the standard manhour setting system 2801;

15 Fig. 67 is a view for explaining a window for displaying original data of simple division or parallel division in the standard manhour setting system 2801;

Fig. 68 is a view for explaining the work contents of stations divided by simple division;

20 Fig. 69 is a view for explaining a user interface window in further editing the workshop divided by simple division;

Fig. 70 is a view for explaining a user interface window for defining the parallel operation between works in parallel division;

25 Fig. 71 is a view for explaining a plurality of composition plans created by parallel division;

Fig. 72 is a view for explaining a user interface

1  
window in further editing composition plan 1 created by  
parallel division;

Fig. 73 is a view for explaining a user interface  
window in further editing composition plan 2 created by  
5 parallel division;

Fig. 74 is a view for explaining a user interface  
window for defining a load target in loading data from the  
standard manhour setting system 2801 in the work assignment  
system 2802;

10 Fig. 75 is a view for explaining the reason why the  
data load range can be changed and defined in various ways  
in the work assignment system 2802;

Fig. 76 is a view for explaining a user interface  
window in opening an existing file in a composition table  
15 file 6400;

Fig. 77 is a view for explaining a state wherein the  
work data loaded in the memory of the work assignment system  
2802 are displayed for each "target model";

Fig. 78 is a view for explaining a user interface  
20 window in adding a work in the standard manhour setting system  
2801;

Fig. 79 is a flow chart for explaining the control  
procedure of simple division by the work assignment system  
2802;

25 Fig. 80 is a view for explaining the states of five  
stations divided by simple division by the work assignment

system 2802;

Fig. 81 is a view for explaining work division in the stations in the work assignment system 2802;

Fig. 82 is a view showing a state wherein a work having  
5 a large manhour is assigned to station 2 to be parallel-operated in the workshop having five stations so as to explain work assignment;

Fig. 83 is a view for explaining the work division result in the stations in the work assignment system 2802;

10 Fig. 84 is a view for explaining a user interface window for station division in the work assignment system 2802;

Fig. 85 is a view for explaining a user interface window for adding or inserting a station in the work  
15 assignment system 2802;

Fig. 86 is a view for explaining a method of displaying a station to which a work having a large manhour is assigned by the work assignment system 2802;

Fig. 87 is a view for explaining an authentication  
20 window for authenticating a user who will compose works;

Fig. 88 is a block diagram for explaining the overall arrangement of a system according to a modification in which each subsystem has a standalone structure;

Fig. 89 is a view for explaining a state wherein  
25 operations of each of a plurality of works, and images and parameters corresponding to the respective operations are

related to each other and stored;

Fig. 90 is a view showing images (images representing a continuous operation) continuously generated by designating parameters in accordance with the method shown in Fig. 89;

Fig. 91 is a view showing a dialog box for inputting a component symbol in relation to Fig. 39;

Fig. 92 is a view showing a user interface window for grouping a plurality of works in composing works;

Fig. 93 is a view showing a user interface window for grouping a plurality of works in composing works;

Fig. 94 is a view showing a user interface window for grouping a plurality of works in composing works;

Fig. 95 is a flow chart for explaining a control procedure for work assignment as a modification to Fig. 79, i.e., a composition control procedure that the number of stations assigned works preferentially should not exceed the number of stations  $N_{ST}$ ;

Fig. 96 is a flow chart for explaining a control procedure for work assignment as another modification to Fig. 79, i.e., a composition control procedure for preferentially averaging the manhours of works assigned to stations; and

Fig. 97 is a view showing the state of parallel-operated station 2 in the workshop of the example shown in Fig. 85.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

An embodiment in which the present invention is applied to a printer manufacturing process will be described below in detail with reference to the accompanying drawings.

The overall system to be described in this embodiment is called an "assembly standard information management system". As shown in Fig. 28, this assembly standard information management system comprises three subsystems:

- work standard creation subsystem 2800,
- standard manhour setting subsystem 2801, and
- work assignment subsystem 2802

In the following explanation, these subsystems will be referred to as the work standard creation system 2800, standard manhour setting system 2801, and work assignment system 2802, respectively, for the descriptive convenience.

The work standard creation system 2800 creates (defines) a work standard (work standard data) for the standard manhour setting subsystem 2801 and work assignment subsystem 2802. In the work standard creation system 2800, the user is required to understand, for each work to be executed in the manufacturing process, a "verb" representing an operation of the work, an "object" that describes the target of the work, and some "comments" and also have knowledge for the manufacturing process enough to sequentially describe the flow of the series of works.

The standard manhour setting system 2801 determines the standard manhour for the work standard created by the work standard creation system 2800.

The work assignment system 2802 determines composition  
5 (work composition) using the work standard created by the work standard creation system 2800. -

<Overall Arrangement>

Fig. 1 shows the hardware configuration of the assembly standard information management system. As shown  
10 in Fig. 1, this assembly standard information management system has a plurality of clients and one server (or a plurality of servers). The computer system of each client (to be referred to as a client system hereinafter) has, e.g.,

- OS: Windows95/98,
- 15 · DB connection software: ODBC driver for Oracle,
- communication network software: SQL-Net for Oracle,
- work standard creation system application program,
- standard manhour setting system application program, and
- work assignment system application program.
- 20 On the other hand, the server-side computer has a system configuration comprised of
- OS: Windows-NT server, and
- database: Oracle WorkGroup Server

On the assembly standard information management system  
25 constructed by a plurality of clients and one or a plurality of servers, three application programs or the "work standard

creation system 2800", "standard manhour setting system 2801", and "work assignment system 2802" simultaneously or independently run in the so-called client/server environment.

5           Current computer hardware capable of realizing the general client/server environment can be applied to each of the internal hardware configurations of the server and clients of the assembly standard information management system, and a detailed description thereof will be omitted  
10 in this embodiment.

<Work Standard Creation System 2800>

The work standard creation system 2800 defines/creates master data to be used by the standard manhour setting system 2801 and work assignment system 2802.

15           A "work standard" represents a certain work unit in the manufacturing process. One work process (to be referred to as a process hereinafter) is formed from a plurality of work standards (or one work standard in some cases). To manufacture products of a model, a plurality of processes  
20 are defined for the products of the model, and one or a plurality of work standards are defined for each process, as shown in Fig. 2.

Referring to Fig. 2, process 1, process 2, ..., process N are defined for a representative model A. A plurality of  
25 "work standards" can be defined for each process. Each work standard is input through an input window (either from the

client terminal or the server terminal) as shown in Fig. 3.

As will be described later, in this embodiment, the basic work unit is called a "work standard" that is the base of work in the assembly process. However, the "assembly standard information management system" of this embodiment  
5 is finally a system for managing assembly of products in the factory and therefore is preferably capable of management not at the work standard level but at the product level.

As will be described later, one work is assigned one  
10 identifier (or directory). Sets of a plurality of work standards are classified using a hierarchical structure including "target model", "representative model" as the upper level thereof, and "genre" as the further upper level (e.g., a genre such as "printer" or "camera"). More  
15 specifically, the CRT window (display window) of the terminal displays menus:

- "create" menu, and
- master maintenance

When the user selects the "create" menu in this display  
20 window, a dialog box for inputting the name of "representative model" and the name of "process" appears on the screen of the display unit. In this window, the user inputs the name of "representative model" and the name of "process". For example, assume that the input name of  
25 "representative model" is "BJC-4200", and the input name of "process" for the model "BJC-4200" is "total assembly". The

application program will create a record "total assembly" under a record "BJC-4200" and create a plurality of work standard records under the record "total assembly".

The main menu of the application program includes "work  
5 standard", "edit", ..., and the pull-down menu of the "work standard" menu includes "file new (N)".

The input window shown in Fig. 3 is displayed when the "file new (N)" is selected. That is, this application program allows the user to define a certain work of the  
10 representative model "BJC-4200" through the input window shown in Fig. 3. The user inputs the name of the work in a "work name" field 312.

In addition to the "work name" field 312, a window 300 shown in Fig. 3 has  
15 · a field 302 to which the name of an "applied model" is to be input,  
· an input field related to parts to be used in this "work" ("part number" field 303, "part name" field 304, and "quantity" field 305),  
20 · an input field related to tools to be used in this "work" ("tool/treatment device/auxiliary material" field 306, "quantity" field 307, and "check etc." field 308),  
· a field related to work standards as characteristic input items of this application program ("number" field 309, "work  
25 standard" field 310, and "note" field 313), and  
· a field 311 to which information related to a later

revision/change of this "work" is input.

Fig. 4 shows files opened by this application program, which form a master data file group. Each master file will be described later.

5 Fig. 5 is a flow chart for explaining the input procedure for the input window shown in Fig. 3.

First, an input to the "applied model" field 302 is done in step S100 shown in Fig. 5.

10 The input in this step can be done in two ways: a direct input method by which the user directly inputs data to the field using a keyboard, and a menu input method by which an icon 301 is clicked to display a window with the list of a plurality of candidate names of the "applied models", as shown in Fig. 6, the user selects one of the displayed  
15 candidate names using a mouse or the like, and the selected name is input to the field 302. In the example shown in Fig. 7, the names of a plurality of "applied models" selected in the window shown in Fig. 6 are input to the field 302.

20 In step S200, the user inputs a desired note to the note column through the keyboard.

In step S300, the user inputs data related to parts or tools to a predetermined field through the keyboard while moving the cursor to an arbitrary position in the field using the mouse.

25 A part number pairs with a part name. When one of them is input, a part data master file 40 (Fig. 4) is searched

(so-called incremental search) using the input character sequence as a keyword, so all pairs of part numbers and part names having that keyword are displayed, as shown in Fig. 8. The user selects a pair from the displayed candidates, so  
5 the selected pair data is output to a predetermined field.

The method of incremental search used for the above search will be described with reference to Figs. 9 and 10.

In the incremental search, search is executed using characters input until the current time as a keyword to  
10 display candidates searched at the current time, and every time one more character is input, the candidates that have already been searched are narrowed down to only those matching the character sequence including the added character.

15 In the example shown in Fig. 9, when "GE" ("げ") is input to an input field (upper field), various words and phrases starting with "げ" are displayed in an output field (lower field) as candidates. Further, when "NZO" is input next to "げ", words and phrases starting with "現像 (GENZOU:  
20 developing)" are displayed in the output field as candidates, as shown in Fig. 10. That is, the candidates shown in Fig. 10 are narrowed down from those shown in Fig. 9. Note, that English translations corresponding to each of the Japanese candidates are described, for easy understanding, in  
25 parentheses after the Japanese candidates in Figs. 9 and 10.

The description will be continued referring back to

the flow chart shown in Fig. 5.

In step S400, pieces of information related to tools and the like are input to the fields 306, 307, and 308. For this data input as well, the direct input using the keyboard  
5 and the method of searching from the master file (tool file 60) are prepared, like the input in step S300.

In step S500, the user inputs details of a work standard for the work to be defined. The data input for definition of a work standard is the gist of the data input in the work  
10 standard creation system 2800, and a dedicated input window as shown in Fig. 11 is prepared. Details of step S500 are included in the control procedure shown in Fig. 14.

When the user double-clicks on an arbitrary part of the "work standard" field 310, the input window shown in  
15 Fig. 11 is displayed. When a work standard has already been input to the double-clicked position, i.e., when the user double-clicks on a portion where the name of an already input "work standard" is displayed, details of the already input work standard are displayed in the window shown in Fig. 11.

20 As shown in Fig. 11, one "work standard" comprises

- a "comment 1" field 1101,
- an "object" field 1102,
- a "comment 2" field 1103, and
- a "verb" field 1104.

25 "Operation" that defines one work is defined by the "verb" field 1104, and the target of the "operation" is defined by

the "object" field 1102. The subject of the operation in the "verb" field 1104 is an operator. Hence, who is the operator need not be explicit.

"Comment 1" describes a comment about the "object".

5 "Comment 2" describes a comment about the "verb". For example, if

"comment 1" = "at www position",

"object" = "xxxx",

"comment 2" = "become yyyy",

10 "verb" = "do zzzz"

are input, the user understands when the work standard is displayed that the operator should execute a work of "doing zzzz such that xxxx at www position becomes yyyy". Hence, appropriate and simple information must be input to the

15 fields 1101 to 1104 assuming the above understanding by the operator. In other words, standardization is impossible if the user arbitrarily inputs data to the fields 1101 to 1104.

To avoid this, the work standard creation system 2800

prepares in advance a standard database 70 already input in

20 relation to "comment 1", a standard database 80 already input in relation to "object", a standard database 90 already input in relation to "comment 2", and a standard database 100 already input in relation to "verb", as shown in Fig. 4.

Additionally, when the user is going to input the respective

25 items related to the work standard, the above-described incremental search method for the master databases

corresponding to items that the user will input allows the user to execute reference input of already input data. Hence, defined standard terms can be input to the fields 1101 to 1104 regardless of the user.

5           The reference input operation related to the work standard will be described here with reference to Fig. 11 and the like.

Referring to Fig. 11, a field 1105 is divided into a reference instruction field 1105a and a work standard display  
10   field 1105b. "00\*" is always displayed in the reference instruction field 1105a. The user who requires the reference input should double-click on the field 1105a.

An explanation will be done below by exemplifying a data input to the "comment 1" field 1101.

15           First, the user selects the field 1101 to notify the system that the user requires the data input of comment 1.

When the user double-clicks on "00\*" in the field 1105a, the fields 1101 to 1104 shown in Fig. 11 disappear, and instead, a field 1201 in which a keyword for search of a  
20   reference item can be input and a field 1202 in which a plurality of reference item candidates are to be displayed are displayed, as shown in Fig. 12.

For example, as shown in Fig. 13, assume that the input to the "comment 1" field 1101, "object" field 1102, and  
25   "comment 2" field 1103 is ended, and data "移動させる (IDOUSASERU: move)" is to be input to the "verb" field 1104

next. In this case, the user selects the "verb" field 1104 in the input window shown in Fig. 11 and double-clicks on "00\*" in the field 1105a. Then, the window changes to that shown in Fig. 13.

5           The user does not know the standard verb for the operation "移動させる (IDOUSASERU: move)" but knows that at least the character "動 (DOU: move)" must be used. Referring to Fig. 13, the user inputs "動 (DOU: move)" to the field 1201. The system searches the "verb" master database file 100 for  
10 all verb data having the character "動 (DOU: move)". In the example shown in Fig. 13, verbs

"移動させる (IDOUSASERU: move)",

"往復動作させる (OUFUKUDOUSASASERU: reciprocally move),

and

15           "動かす (UGOKASU: move)

are stored in the database 100. These words are searched for the displayed in the field 1202. The user selects "移動させる (IDOUSASERU: move)" in the field 1201 through this window. When "移動させる (IDOUSASERU: move)" is selected in the window  
20 shown in Fig. 13, and then, the ENTER key of the keyboard is pressed, the window returns to the window shown in Fig. 11, where "移動させる (IDOUSASERU: move)" is displayed in the field 1104.

The reference input is used for the input to all the  
25 fields 1101 to 1104 (steps S506 to S512 in Fig. 14).

A plurality of work standards are displayed in the

field 1105 except the field 1105a. Fig. 15 shows that four work standards (procedures 01 to 04) are input.

Each of the work standards can be assigned a note, as shown in Fig. 16.

5 A note is input to a field 1106. The reference input function can also be used for the input of a note. More specifically, when the user wants to add a note to the already defined work standard 01 (displayed in the field 1105b), the user selects the field 1105b using the mouse and then selects  
10 the field 1106 using the mouse. If the user individually requires the reference input, the user double-clicks on "00\*" in the field 1105a. Then, a field 1107 changes to a keyword input field 1601 and reference item display field 1602, as shown in Fig. 16. For example, when the user wants to refer  
15 to a note including a word "注意 (CHUI: note)", the user inputs "注意 (CHUI: note)" to the field 1601. The work standard creation system 2800 searches the note database 50 (Fig. 4) and displays all notes including "注意 (CHUI: note)" in the field 1602, as shown in Fig. 16. When the user selects a  
20 desired note using the mouse and presses the ENTER key, the note is displayed in the field 1107, as shown in Fig. 17.

In this system, an input data editing function is prepared as processing in step S514 (Fig. 14).

25 In this editing function, to individually change a character in data representing work contents, the number of the work standard to be changed is selected in the field 1107,

and the work standard is double-clicked. Then, the data of "comment 1", "object", "comment 2", and "verb" assigned to the procedure are displayed in the fields 1101 to 1104, respectively, and a note corresponding to the procedure is displayed in the field 1106. The user individually corrects the data in each field.

A method of editing one unit of the work standard will be described next with reference to Fig. 18. Editing each unit of the work standard means an operation of deleting one work standard, an operation of setting the same work standard to another sequential position, or an operation of setting (inserting) a "free" work standard between two arbitrary work standards adjacent to each other.

A menu 1802 shown in Fig. 18 is opened, for example, when the right mouse button of the client is clicked.

In this menu 1802, editing functions including

- cut, copy, paste, add, delete, and
- undo, revise (change), revise (delete)

are set.

To "delete" a work standard, the target work standard is selected, and the "delete" menu is selected. To copy the contents of a work standard, the "copy" menu is selected. To paste work standard data copied in the work memory to a desired sequential position, the sequential position is selected, and the "paste" menu is selected. With this "paste" operation, the contents of the work standard at the

paste position are popped down.

To set a free work standard to the position of sequence 01, procedure 01 is selected in Fig. 18, and the "add" menu is selected. In the example shown in Fig. 18, work standards 5 01 to 03 sequentially move to procedure positions 02 to 04, and a free procedure is set to procedure position 01.

These various editing functions for "work", which are prepared in the work standard creation system 2800, are commonly used as editing functions in the standard manhour 10 setting system 2801 or work assignment system 2802 to be described later. The mouse operation for these editing functions is also common. The operation is simplified by this common scheme.

A function of changing the order of a plurality of 15 already input work standards will be described with reference to Figs. 18 to 20.

Assume that three procedures or works:

- 01: confirm 100V system
- 02: wind AV cord
- 20 · 03: set CRG holder

are currently set as work standards, as shown in Fig. 18, and the user wants to exchange procedure 01 with procedure 02. In this case, the user selects procedure 01 and selects the "cut" menu. With the series of operations, the contents 25 of procedure 01 are saved in the work memory, and the contents of procedures 02 and 03 are sequentially shifted to

procedures 01 and 02, as shown in Fig. 20. Next, the operator selects the procedure to be exchanged (procedure 02 in the example shown in Fig. 20) and selects the "paste" menu. As shown in Fig. 19, the contents of all procedures from  
5 procedure position 02 are sequentially popped down to the lower procedures, and simultaneously, the contents of original procedure 01, which are saved in the work memory, are pasted to procedure position 02.

With the above operation, the input or editing in steps  
10 S502 to S514 in Fig. 14 is ended. The user presses an OK button 1108 to indicate that the input of work method is ended.

When the OK button 1108 is pressed, the window returns to the window shown in Fig. 3. In the window shown in Fig. 3, especially, the plurality of set work standards would be  
15 displayed in the field 310, and the note would be displayed in the field 313.

The user gives a "work name" as a standard work to the plurality of work standards set in the field 310. That is, the user inputs the work name to the field 312.

20 When setting of one standard work is ended, the user selects "save" in the menu shown in Fig. 21.

<Editing of Work Contents>... Work Standard Creation System  
2800

To edit work contents, "open" in the "work standard"  
25 menu is selected (Fig. 22), and the work standard to be edited is selected using the mouse (Fig. 23). When an OK icon 2301

is clicked, the selected work is displayed (e.g., as shown in Fig. 3). Editing is done through almost the same window as in the input.

<Input of Graphic Data>... Work Standard Creation System 2800

5           The assembly information management system can display a process set by the work assignment system 2802 at the site of work (client side). For example, when window display shown in Fig. 3 is done at the site of work, the operator can see the display and confirm the work contents, notes,  
10   tools, and parts at a glance. In this system, an image can be attached to each work standard in addition to the above character information for the work.

Fig. 24 shows a window for inputting graphic data. This window is displayed when the user selects the  
15   "illustration" menu (menu on the right side of the "edit" menu") in executing the application program of the work standard creation system 2800, and a graphic pattern displayed in accordance with the selection operation can be edited. The image file to be edited is created in advance  
20   by a presentation application program PowerPoint (available from Microsoft) or Canvas and stored as a graphic file 120.

When the user selects the "display" submenu in the "illustration" menu, an illustration display column 2500 (Fig. 25) is displayed. The user inputs the name of a file  
25   to be attached to a "file name" field 2501 in the display column 2500. In accordance with the input, the system

searches for the file whose name is input to the "file name"  
field 2501 and displays it in the column 2500. In the example  
shown in Fig. 26, an image file "so-09.wmf" is displayed at  
a position corresponding to the illustration display column  
5 2500 shown in Fig. 25 as the result of user's file name input  
operation. -

To edit the image, the authoring tool for editing is  
selected, and then, the "edit" menu is clicked, as shown in  
Fig. 27. After the end of editing, the update result can be  
10 saved by clicking on an "update" icon 2602 (Fig. 26).

In the above example, the image is a still image in  
the BMP format. However, it may be a moving image compressed  
by MPEG.

A so-called animation image may be stored in the  
15 graphic file 120 (Fig. 4). In this case, each animation  
image is stored with predetermined parameters unique to the  
operation of the image.

In assigning parameters unique to an operation to the  
operation in advance, if operations are, e.g., "screw",  
20 "rotate", and "open", for example, pieces of parameter  
information:

- operation: screw → parameter values: direction of screwing,  
moving distance, torque amount,...
- operation: rotate → parameter values: direction of  
25 rotation, moving distance,...
- operation: open → parameter values: direction of opening,

moving distance, weight,...

are registered.

An image with such parameters is registered in the graphic file 120 by combining the directory name, operation  
5 (verb) name, and parameters for each animation image, as shown in Fig. 89.

When the graphic file 120 stored in the state as shown in Fig. 89 is present, and in this state, a work standard is defined in the window shown in Fig. 11, the value of a  
10 parameter to be set for the work standard is written in the "comment 1" or "comment 2" field in units of operations of the work standard. The system compares each operation with each of the verbs and the parameter value in the comment with each of the parameter values registered in the graphic file  
15 and assigns the directory of an animation image having matching operation and parameter to the work standard. The directory name of the assigned animation image is displayed in a field 2601.

Fig. 90 shows an example in which three work standards:  
20 · screw A.  
· rotate main body, and  
· open cover  
are defined for a product. In this example, two continuous still images (animation images) are assigned to each  
25 operation. In other words, when the parameters of the respective operations are assigned to the three work

standards, a series of images  $A1 \rightarrow A2 \rightarrow B1 \rightarrow B2 \rightarrow C1 \rightarrow C2$  are continuously displayed, so a work instruction easy to understand can be easily created. In addition, only by designating an operation name and parameter, an animation  
5 image corresponding to the work parameter can be designated.

When an animation image is employed, no photorealistic image need be prepared, so work standard data can be created at the initial preparation stage before the start of operation of the factory. For creation of work standard data  
10 at the initial stage, automatic image data designation using parameters is preferable.

#### <Translation>... Translation System

Assembly work is not always done only in Japan. This system for standardizing assembly work expects operation not only in Japan but also in many foreign factories (for example,  
15 factories in the English-speaking zone and Thai-speaking zone). For this purpose, the work standard creation system 2800 has a translation system 2803.

As shown in Fig. 28, the translation system 2803  
20 downloads master data created by the work standard creation system 2800 from the work standard creation system 2800, and after translation, uploads the translated master data to the work standard creation system 2800, as shown in Fig. 28.

The menu of the translation system 2803 includes  
25 "upload" for uploading work standard data to the master file, "work standard download" for downloading work standard data

from the master file, and "work standard translation" for starting translation, as shown in Fig. 29. Icons for switching the translation target between work standard and master data are also prepared.

- 5           For example, when work standard data is selected as a translation target, a window 3000 as shown in Fig. 30 is displayed to prompt the user to input a "representative model name" (3001) and "process name" (3002).

- 10           With a check box 3003, display of the entire text, display of only an untranslated portion, or display of only an error portion of translation is selected as the range of the display target. With a check box 3004, the translation language can be selected. When the user clicks on a "display" icon button 3007, the names of all works having the model  
15   name input to the "representative model name" field 3001 and the process name input to the "process name" field 3002 are displayed in a display area 3005.

- If the user wants to translate all works in this display state, he/she clicks on a "select all" button 3006 to select  
20   all works. If the user wants to translate some works, he/she selects the names of works to be translated in the area 3005 using the mouse or the like and clicks on a "translate" button 3008. In accordance with clicking by the user, translation starts. When translation by the translation system 2803 is  
25   ended, "x" in the "auto-translation" column on the right side of the translated work name in the area 3005 changes to "

○".

For work names (field 312 in Fig. 3), part names (field 304), tools and the like (field 306), and notes and the like (field 313) of text data registered in the master data file, the translation system 2803 converts the Japanese to the English using a dictionary. Since this is conversion from words to words, a dictionary (table) is preferably used. Especially, since this work standard creation system 2800 uses the incremental search in inputting data, standard terms are used, and arbitrary word selection is eliminated, as described above. For this reason, the conversion accuracy improves.

However, the work procedure (field 310) is manually input by the user. This is because the language structure of the Japanese is largely different from that of the English, and data (especially comment 1 and comment 2) constructing the work standard with high arbitrariness (i.e., close to a natural language) is unsuitable to conversion using a table.

To prevent a bulky system configuration, the translation system 2803 does not employ a translation method using language analysis (semantic analysis). A reason for this is as follows. In work management, many natural language texts are not always input. Translation is necessary only on a limited occasion when a work is to be newly defined, or work contents are to be changed, so machine

translation that is expensive and time-consuming for  
maintenance is inappropriate. Between European languages  
(e.g., English and German) having relatively similar  
language structures, machine translation is appropriate even  
5 for the contents of work standards.

Another reason why the advanced machine translation  
is not employed between, e.g., Japanese and English is the  
problem of operating system. That is, there is currently no  
operating system depending on two languages. For example,  
10 the WINDOWS of Japanese version and WINDOWS of English  
version do not simultaneously run for the work standard  
creation system 2800.

In addition, currently, a work standard is created  
using one language (e.g., on the Japanese side), and only  
15 software that runs on the WINDOWS (or WINDOWS NT) of Japanese  
version has the function of converting the Japanese text to  
English. In other words, converting various terms (text  
data) created by the work management system to the language  
of another country depends on the function of the language  
20 of the operating system based on the official language of  
that country. For this reason, conversion using a table is  
most reliable for easy translation to the language of that  
country.

As described above, this translation system uses word  
25 conversion using a table (table dictionary) for a word in  
a work standard. Additionally, if the table dictionary also

stores a converted word for a phrase longer than a word, the phrase is replaced with the converted word. In principle, a word in a work standard, which cannot be completely translated even using the table dictionary, is manually  
5 corrected.

To confirm the translation result for a work, the name of the work is selected in the display area 3005, and the "display" button 3007 is clicked. Then, a window as shown in Fig. 31 is displayed. Whether the translation has been  
10 appropriate is determined by checking the translation result. To verify the adaptability between a specific English word and a corresponding Japanese (adaptability of translation result), the word portion is double-clicked to display a correction window 3200 as shown in Fig. 32.

15 All work standards of the work with this work name are displayed in Japanese in an area 3202. English work standards corresponding to these Japanese work standards are displayed in an area 3204. In the example shown in Fig. 32, work standard 01 is selected. This selected work standard  
20 01 is displayed in Japanese in an area 3201, and an English equivalent of procedure 01 is displayed in an area 3203. The English text is corrected in the area 3202.

<Voice Input>... Translation System

Data input in the work standard creation system 2800  
25 and, more particularly, translation of work standards into the language of another country is done by word conversion

and manual input. Manually inputting a translated text requires the user to have both an ability of translation and an ability of high-speed input using the keyboard. Since it may be difficult to ensure an operator who has both the abilities in that country, the translation operation and input operation are separated. That is, a translation result is recorded by voice input, and the data is input in playing back the recorded voice.

To input (record) voice, a work standard to which input voice is to be attached is selected, and the "new" menu in the voice menu (Fig. 33) of the translation system application program is selected, thereby displaying a window shown in Fig. 34 overlapping the window shown in Fig. 31. When the recording button (●) in the window shown in Fig. 34 is clicked, recording starts. The voice sampling rate and the like are set in advance. To end recording, the ■ button is clicked. To save the recorded voice, "save" in the "work standard" menu is selected.

Fig. 35 shows the storage positions of files saved in the work standard creation system 2800 and translation system 2803.

Both the work standard creation system 2800 and translation system 2803 can process not only voice and image files but also, e.g., MOVIE files by QUICKTIME.

In the work standard creation system 2800, a plurality of files temporarily registered, as shown in Fig. 35, can

reproduced together (including voice and images). For example, when one or a plurality of work standards are selected in the window shown in Fig. 23, and display in the "illustration" menu or "playback" in the voice menu is  
5 selected, the images/voices of the work standards are displayed/played back in the defined order.

The voice and image are preferably synchronized. A QUICKTIME file or MOVIE file can easily synchronize voice and image. The work standard creation system 2800 also  
10 proposes to superpose CG data of an arrow or the like on still image data. During voice playback of a work, the arrow can visually indicate the operator in detail which work portion is being mentioned.

The work assignment system 2802 to be described later  
15 composes the work standard data created by the work standard creation system 2800, thereby assigning each work to a desired workshop. The result is reflected to a composition table file 6400 to be described later. The composition table file 6400 is uploaded to the work standard creation system  
20 2800.

More specifically, the work standard creation system 2800 can input works in the composition order corresponding to actual assembly workshops from the work assignment system 2802 and open the works. The uploaded file has voice data  
25 and image data attached by the work standard creation system 2800. When the voice/image playback function of the work

standard creation system 2800 is exploited at the actual site of assembly, the work contents can be instructed to the operator in detail by voice and image.

<Effect of Work Standard Creation System 2800>

5           According to the work standard creation system 2800 of the above-described embodiment, the following effects can be obtained.

AD-1: The work standard creation system 2800 describes a work related to a work standard by an operation phrase  
10   representing an operation of the work, an object phrase representing the target of the operation, and a comment phrase representing auxiliary information related to the operation or object. Hence, all work standards are  
15   standardized by the elements including the operation, object, and comment phrases.

AD-2: The work standard creation system 2800 is preferably built under a client/server computer system. When a common memory (or disk) connected to the subsystems to store or read out work standards is prepared, a  
20   client/server distribution system for assembly information management is provided.

AD-3: In this embodiment, the translation system 2803 can translate the operation, object, and comment phrases in each record of the standard manhour database into a  
25   predetermined language such that the system can operate in a country with a different language.

AD-4: For translation by the translation system 2803, a translation method using matching to a dictionary is employed in consideration of easiness.

AD-5: Image data or voice data can be attached to a  
5 work standard.

AD-6: Since not only a photorealistic image but also CG data or animation image can be used as image data, work standard data can be created at the initial stage quite before the actual operation of the factory.

10 <Standard Manhour Setting System 2801>

The standard manhour setting system 2801 is a system for determining the standard manhour of a desired work and is connected to the work standard creation system 2800. More specifically, as shown in Fig. 28, the standard manhour  
15 setting system 2801 and work standard creation system 2800 share master data and the like. Determination of the standard manhour by the standard manhour setting system 2801 is preferably done in the form of so-called batch processing. Hence, after master data including work standard data as the  
20 determination target is downloaded to the standard manhour setting system 2801, the standard manhour setting system 2801 determines the standard manhour.

The above-described work standard creation system 2800 does not input manhour data. The work standard creation  
25 system 2800 does not give a manhour value to a standard work because, in the standard work created by the work standard

creation system 2800, the manhour value given to each work must not vary depending on the person or day. The idea is that the manhour value is determined by the user who will compose works at the time of composition. To standardize the  
5 manhour value, the standard manhour setting system 2801 uses standard data as basic manhour data.

As shown in Fig. 28 or 36, the standard manhour setting system 2801 outputs a manhour setting file 3601 using, as reference files, a standard data (to be referred to as CS -  
10 (C. Standard data) hereinafter) file 2804 and operation pattern data file 2806.

Fig. 37 shows the data structure of the manhour setting file 3601. The manhour setting file 3601 shown in Fig. 37 has records in units of element works and has the names of  
15 the element works, the frequencies of the element works, the manhours of the element works (unit: RU), the values of "CS", and the values of "set conditions". More specifically, the value of the directory of a data file containing the contents of a set condition given to the work is stored in the "set  
20 condition" field. The value of the root directory of the set condition data file is stored in the "CS" field.

Fig. 38 shows the data structure of the standard data file 2804. Each record of the standard data file 2804 is called a standard material. As shown in Fig. 38, each record  
25 of the standard data file 2804 has a "comment 1" field, "object" field, "comment 2" field, "verb" field, and "set

condition" field. The "comment 1", "object", "comment 2", and "verb" fields in the standard data file 2804 are the same as those in the work standard creation system 2800. Set condition data will be described later.

5           Fig. 39 shows examples of the data structure in the standard data file 2804. Referring to Fig. 39, standard material data 3901 of an element work has directories "SPG3/T133/M11/0", and standard material data 3902 of another element work has directories "ASHD/T11222/T1111".

10           The operation pattern data file 2806 has the same data structure as that of the CS data file 2804. More specifically, work data contained in the operation pattern data file 2806 include data as shown in Fig. 38, which are related to works actually executed in the past. Only the difference from the  
15           standard data file 2804 is whether the work is recognized as a "standard".

As described with reference to Fig. 2, there are an infinite number of works related to manufacturing a device (printer) as a product. However, as described with reference  
20           to Figs. 1 to 35, the work standard creation system 2800 can easily define a number of element works as "work standards" each constituted by

- two comments,
- object, and
- 25   · verb

Especially, as shown in Fig. 2, work standards are classified

into processes, and processes are classified into models. In other words, models, processes, and works have tree structures, as shown in Fig. 2.

On the other hand, the work assignment system to be  
5 described later changes the composition of element works in  
- consideration of the manhour. That is, the work standard  
creation system 2800 defines works, and the standard manhour  
setting system 2801 sets the manhour such that the composing  
operation by the work assignment system 2802 is facilitated.

10 The work standard creation system 2800, standard  
manhour setting system 2801, and work assignment system 2802  
commonly have work elements with identifiers. However,  
since the identifiers themselves do not make the user  
remember the work contents, the master files cannot be  
15 searched using the identifiers of work elements (standard  
works). Hence, this system is designed to be able to execute  
multi-keyword searching using, as keywords, a total of four  
phrases, i.e., two comments, object, and verb common to all  
the systems.

20 To give a manhour to each work created by the work  
standard creation system 2800 in advance, the standard  
manhour setting system 2801 searches the standard material  
data file 2804 using the total of four phrases, i.e., two  
comments, object, and verb (the combination of these four  
25 keywords will be referred to as a "work identification  
multi-keyword" in this specification) and gives manhour data

(the above-described "manhour" and "set condition") attached to the found standard data to each work data of data created by the work standard creation system 2800.

The outline of this procedure is shown as a flow chart

5 "search of manhour standard material" on the left side of Fig. 40. Referring to this flow chart, work standard data created by the work standard creation system 2800 is loaded in step S4001. In step S4002, it is determined for each work whether data having work identification keywords matching

10 (or partially matching or ambiguously matching) the work identification multi-keyword of the work is present in the standard material data file 2804, and if so, manhour data HS of a record in the standard material data file is assigned to the work standard data. For example, work data loaded from

15 the work standard creation system 2800 is represented by X, and a work identification multi-keyword of the data X is represented by KW. In step S4004, the user has a chance to confirm whether the assigned manhour data HS is appropriate.

On the other hand, it is determined in step S4002 that

20 the work identification multi-keyword KW of the work data X is not present in the standard material data file 2804, a record having the work identification multi-keyword KW is searched for from the operation pattern data file 2806 in step S4010.

25 As described above, the operation pattern data file 2806 has the same data structure as that of the standard

material data file 2804. The difference between the two files is that data in the operation pattern data file is not a standard but at least has manhour data set in the past. When such work data is present in the operation pattern data  
5 file 2806, manhour data HP set for the work data is assigned to the target work. In step S4014, the user is given a chance to confirm whether the manhour data HP is correct.

That is, in the flow chart "search of manhour standard material" on the left side of Fig. 40 and the flow chart  
10 "search of operation pattern" at the central portion of Fig. 40, manhour data is automatically searched from standard material data or past data and assigned without intervention of the user. However, there must be works unsuitable to automatic assignment. The flow chart on the  
15 right side of Fig. 40 explains a user's procedure of directly setting manhour data to a work unsuitable to automatic assignment by the user.

As is apparent from Fig. 36, the standard manhour setting system 2801 has three routes to set manhour data.  
20 Referring to Fig. 40, the route using the standard material data file 2804 is called a "first route", the route using the operation pattern data file 2806 is called a "second route", and the route in which the user directly analyzes a work and assigns manhour data is called a "third route"  
25 for the descriptive convenience.

The work or procedure in Fig. 40 will be described

using a detailed example shown in Figs. 41 to 44. Fig. 41 is a view for explaining for explaining data load in step S4001 of Fig. 40. Fig. 42 is a view for explaining the operation of the first route in detail. Fig. 43 is a view for explaining the operation of the second route. Fig. 44 is a view showing a detailed example of the final manhour setting file 3601 obtained by the operation in Figs. 41 and 42.

As for the operations shown in Fig. 40, the operation of the first, second, or third route is performed every time a work data file is downloaded from the work standard creation system 2800, i.e., every record of the work data file. However, Figs. 41 to 44 show the operations as if the operation of the first, second, or third route were performed at once for all the downloaded files, for the illustrative convenience.

Referring to Fig. 41, the manhour setting file 3601 before data load has the data structure shown in Fig. 37. When data created by the work standard creation system 2800 is loaded to the manhour setting file 3601, the "comment 1" field, "object" field, "comment 2" field, and "verb" field in the work data file are loaded as an "element work name". Since the work data file does not contain manhour data, the manhour setting file 3601 has no manhour data at the stage of data load in Fig. 41.

For the descriptive convenience, the Japanese texts

in the "element work name" field of the manhour setting file 3601 shown in Fig. 41. are not translated to English, and English equivalents of these texts are indicated by \*1 to \*5 in the margin of Fig. 41. This aims at indicating that  
5 when data in the respective columns of the table shown on the lower side of Fig. 41, which are created by the work standard creation system 2800, are directly loaded in this order, and the data in the row direction (horizontal direction) of the columns are connected, these data form  
10 significant Japanese texts in that word order in the "element work name" field.

Although each "element work name" shown in Fig. 42 and the like is illustrated as a series of text data for the illustrative convenience, the "element work name" field is  
15 actually separated into the "comment 1" field, "object" field, "comment 2" field, and "verb" field.

Fig. 42 explains the first route. For example, when the first record is downloaded from the work standard creation system 2800, standard data having the keyword KW  
20 "set load spring in treatment device for attaching load spring" is searched from the standard material data file 2804.

The symbol "\*" in the keyword formula shown in Fig. 42 and the like will be described here.

25 The "\*" is a symbol representing a wild card and can have an arbitrary value. Data shown in the first record of

the standard material data file 2804 shown in Fig. 42 are

- comment 1 = \*
- object = \*"バネを (BANE0: spring)"
- comment 2 = \*"に (NI: to)"
- 5 · verb = "組み込む (KUMIKOMU: set)"

That is, since the "comment 1" field of the first record is designated to "\*", it matches any text data contained in the "comment 1" field of the "element work name" field as the work data in the manhour setting file. In a similar  
10 manner, for the "object", any word including "バネを (BANE0: spring)" can match in all records. For the "comment 2", any word including "に (NI: to)" can match in all records. For the "verb", any word including "組み込む (KUMIKOMU: set)" can match in all records.

15 In the example shown in Fig. 42, the first record in the manhour setting file 3601 matches the first record in the standard material data file 2804, which has

"\*, \*バネを (BANE0: spring), \*に (NI: to), 組み込む (KUMIKOMU: set)", and

20 the second record having

"\*, \*を (O), \*に (NI: to), 組み込む (KUMIKOMU: set)"

In the standard manhour setting system 2801, when a record matches two or more records, it is determined that the record matches a record having the highest degree of  
25 matching. The degree of matching is obtained with reference to the number of characters except the wild card. In the

example shown in Fig. 42, the first record in the standard material data file 2804 contains more matching text data than the second record. Hence, it is determined that the degree of matching is higher for the first record in the standard material data file 2804 than for the second record. It is finally determined that the record matches not the second record but the first record.

The first record in the standard material data file 2804 has a time value "41 RU" as a manhour, so "41" is set in the "manhour" field of the first record of the manhour setting file 3601. In addition, the first record in the standard material data file 2804 has "'SPG3/T133/M11/0" as "manhour standard material" data. The root directory of manhour information is "SPG3", and the sub-directories are "T133/M11/0". Hence, "SPG3" is stored in the "CS" field of the first record in the manhour setting file 3601, and data "T133/M11/0" is stored in the "set condition" field.

When this system is used in a non-Japanese-speaking zone, the "degree of matching" is determined with reference to the number of matching words.

For the above search in the standard manhour setting system 2801, perfect matching or partial matching by words or phrases except the wild card symbol are employed, and one candidate is always employed in principle. However, a plurality of candidates may be displayed in descending order of degrees of matching, and the user may finally select a

candidate.

When similar checking is performed for the remaining four records in the manhour setting file 3601, the second record matches no record in the standard material data file 2804, the third records matches the second record in the standard material data file 2804, the fourth record matches - no record in the standard material data file 2804, and the fifth record matches the third record in the standard material data file 2804.

Hence, for the third work data in the manhour setting file 3601, which matches a record, "37" is assigned as a "manhour", "ASHD" is assigned as a "CS", and "T11222/T1111" is assigned as a "set condition". For the fifth work data, "16" is assigned as a "manhour", "PUMB" is assigned as a "CS", and "T2111/T111111" is assigned as a "set condition". Thus, the manhour setting file 3601 is tentatively created as shown in Fig. 42 in accordance with the manhour data setting procedure by the first route.

On the other hand, for the second and fourth work data that do not match any record by the first route, the procedure of the second route is executed as shown in Fig. 43. The text data of "element work names" of the second and fourth work data and the "comment 1", "object", "comment 2", and "verb" in the operation pattern data file 2806 are searched.

In the example shown in Fig. 43, the second and fourth work data match the first and second records in the operation

pattern data file 2806, respectively. Hence, the values  
("/GET-50E/M-10E" and "/GET-50E/M-10E") of the "operation  
pattern" fields of the first and second records in the  
operation pattern data file 2806 are stored in the "set  
5 condition" fields of the second and fourth records in the  
setting file 3601. In this case, the records do not match  
the standard material data file, no value is written in the  
"CS" fields in the setting file 3601. Thus, the operation  
of the second route is ended.

10 In this way, the manhour setting file 3601 is set as  
shown in Fig. 44 by the operations of the first and second  
routes.

The operation of the third route is performed when the  
standard manhour can be determined by neither the first route  
15 nor the second route. In the third route, the standard  
manhour is determined by directly analyzing the WF (Work  
Factor).

The overall operation of the standard manhour setting  
system 2801 has been described above. Details of the  
20 operation of the standard manhour setting system 2801 will  
be described below.

<Data Load>... Standard Manhour Setting System

Fig. 45 shows the initial menu window displayed when  
the standard manhour setting system 2801 is activated. In  
25 this menu, six main menus:

- data load (icon 4501),

- standard manhour processing (icon 4502),
  - standard material creation (icon 4503),
  - master data maintenance,
  - environment setup, and
- 5 · analysis material editing (icon 4504)

can be selected.

Data load is necessary before determination of the standard manhour. When the user selects the data load menu 4501, a window as shown in Fig. 46 is displayed.

- 10 Referring to Fig. 46, the window is roughly divided into to areas. A field 4601 on the left side indicates product symbols created by the work standard creation system 2800, i.e., product numbers (or the names of "representative models") that can be downloaded to the manhour determination
- 15 system.

- Fields 4602 to 4605 on the right side indicate work names downloaded from the work standard creation system 2800 in the past. More specifically, the field 4602 indicates the names of "work standards" downloaded by the standard manhour
- 20 setting system 2801, the field 4603 indicates the "product symbols" of the respective "work standards", the field 6404 indicates the "names" of the respective "work standards", and the field 4605 indicates download dates, i.e., "load dates".

- 25 One or a plurality of "product numbers" to be loaded (downloaded) are selected from the field 4601 using the mouse.

To given a name different from that set by the work standard creation system 2800 to the product to be downloaded, the product number of the product to be named is designated in the field 4601, and the "name" is input to a field 4601. Data  
5 load is started by selecting the product to be loaded with the mouse, clicking on a "select" button 4611, and clicking on an "OK" icon 4612.

When the user clicks on the "OK" icon 4612, work name data is loaded to the memory of the standard manhour setting  
10 system 2801, and a window as shown in Fig. 47 is displayed.

The window shown in Fig. 47 displays the list of works present on the memory of the standard manhour setting system 2801. A work downloaded previously can be discriminated from the current download data by referring to a previous load  
15 date field 4703.

Since the standard manhour setting system 2801 is separated from the work standard creation system 2800, works or work groups to be considered by the standard manhour setting system 2801 itself are present independently of works  
20 or work groups set by the work standard creation system 2800. In the standard manhour setting system 2801, one work (or work group) is independently recomposed by the standard manhour setting system 2801 as another "component".

The component newly set by the standard manhour setting  
25 system 2801 is discriminated from other components by a "component symbol". To create a component, the names of a

plurality of works to be set in the component are selected in a field 4701, the "component symbol set" menu in the edit menu is selected, and a component symbol (field 9101) and name (field 9102) are input through a window as shown in  
5 Fig. 91. Thus, the component symbol is assigned to a field 4702 in Fig. 47 in correspondence with the selected work names.

Referring to Fig. 47, a flag 4705a represents the state of work standard data. When the value of this flag is "N",  
10 it represents that the work standard is newly created. When the value is "C", it represents that the work standard is previously loaded to the standard manhour setting system 2801 and then changed on the standard manhour setting system 2801 side. When the value is "D", it represents that the work  
15 standard is previously loaded to the standard manhour setting system 2801 and then deleted on the standard manhour setting system 2801 side.

A field 4705b has a flag representing the approval state of a work standard. When the value is "F", it  
20 represents that the approver of the work standard is registered.

A field 4706 represents a number assigned to the work standard by the work standard creation system 2800. A field 4707 represents a number given to the work standard by the  
25 standard manhour setting system 2801.

Data is loaded in units of components. When the user

selects the "execute" menu in Fig. 47, a "data load" window 4800 shown in Fig. 48 is displayed. The user designates the component symbol of a load target through a dialog 4801 in the window 4800.

5           More specifically, to load the component symbols of all components displayed, the user checks the "all" button. To designate and load a specific component symbol, the user checks the "designate component" button and inputs the component symbol name to a field 4802. As described above,  
10          for one component, a work name selected in the field 4701 in Fig. 47 with the mouse is recognized as one "component".

As shown in Fig. 49, in the standard manhour setting system 2801, a plurality of components can be defined. A single work can belong to different "components".

15           The advantage of providing "components" on the upper side of works is as follows. Since individual works themselves have high universality, they can hardly be strongly connected to a specific product. However, to re-define works in setting the manhour, or to re-define works  
20          in composing works in the workshop in consideration of the manhour, it is preferable for the user to connect the works to a name easy to remember the product to be manufactured, i.e., the name of the upper level.

Referring back to Fig. 48, the window 4800 also has  
25          a dialog 4803 in which a material to be referred to in automatically setting the manhour. That is, after the data

load, whether an operation of automatically setting the manhour for the loaded work should be performed can be designated by a "standard material (CS) check button 4804 and "analysis material" check button 4805. The "standard material (CS)" is the standard material data file 2804, and automatic manhour setting by checking the "standard material (CS)" is manhour data setting by the above-described first route.

The "analysis material" is the operation pattern data file 2806, and automatic manhour setting by checking the "analysis material" is manhour data setting by the above-described second route. If the user does not want automatic manhour setting, both of the "standard material (CS)" and "analysis material" check buttons are turned off.

When the user clicks on an OK button 4806, the data load is started.

Fig. 50 shows the file structure of the standard manhour setting system 2801. As described above in relation to Fig. 36, the standard manhour setting system 2801 creates the manhour setting file 3601 on the basis of files loaded from the standard material data file 2804 and operation pattern data file 2806.

Referring to Fig. 50, the standard material data file 2804 and analysis material "operation pattern" data file 2806 are created by a standard material creation routine 5001 and analysis material creation routine 5002, respectively, in

advance.

In the above way, more specifically, in accordance with the control procedure shown in Fig. 40 (this control procedure is included in a standard material manhour processing routine 5003), manhour data is automatically set for work data downloaded from the work standard creation system 2800.

As shown in Fig. 49, the respective "works" (the "works" are not the sets of a plurality of detailed works but simple root directories) required to assembly a product are linked by directories through one or a plurality of components (the components may be divided into a plurality of layers). In other words, when the directories are traced, the "product" assembly work can finally reach a work, and which manhour data is set for the work can be confirmed.

The program procedure of displaying work contents for this confirmation is included in the standard material manhour processing routine 5003. The manhour data automatically set by the standard material creation routine 5001 or analysis material creation routine 5002 can also be confirmed by the standard material manhour processing routine 5003. The standard material manhour processing routine 5003 will be described.

<Standard Manhour Processing>... Standard Manhour Setting System

Standard manhour processing is executed by clicking

the "standard manhour processing" icon 4502 (Fig. 45).

Individual "element works" correspond to work data and have a structure as shown in Fig. 38, as described above.

The standard material manhour processing routine 5003  
5 is executed in accordance with the control procedure of the flow chart shown in Fig. 51. For the control procedure shown in Fig. 51, the directories are linked using a hierarchical structure

Product → component → model → work

10 In step S600, the "product" as a manhour setting target is selected. Fig. 52 shows the product selection window. The target "product" is selected with the mouse or the like, and a "set manhour" button 5201 is clicked. When this button is clicked, the flow advances to step S602 to select a  
15 "component". Fig. 53 shows the "component" selection window. A target component is selected with the mouse or the like, and a "next" button 5301 is clicked. When this button is clicked, the flow advances to step S604 to select a "model". Fig. 54 shows the "model" selection window. At this stage,  
20 in the example shown in Fig. 54, since the user has selected the "product" and "component", "BJ-970909" and "97-09-09 load" are displayed as a product symbol and product name, respectively. In addition, "CH" is displayed as a component symbol.

25 Next, the target "model" is selected with the mouse or the like ("BJC-4300" is selected in the example shown in

Fig. 54), and a "next" button 5401 is clicked. When this button is clicked, the flow advances to step S606 to select a "work" to be edited.

Fig. 55 shows the dialog for causing the user to select a "work" to be edited. At this stage, in the example shown in Fig. 55, since the user has selected the "product" and "component", "BJ-970909" and "97-09-09 load" are displayed as a product symbol and product name, respectively. In addition, since "CH" is displayed as a component symbol, and "BJC-4300" is selected as the "model", "BJC-4300" and "xxxxxxx" are displayed as a set model symbol and model name, respectively.

Referring to Fig. 55, a plurality of works are displayed. In a field 5501, the "formal management No" of each work is set. In a field 5502, the "name" of each work is set. In a field 5503, the manhour value set for each work is set.

A field 5504 ("USE" field) stores the directory (corresponding to "set condition field" in the example shown in Fig. 43) of manhour set on the basis of automatic manhour setting by the second route, i.e., the operation pattern data file 2806 (this file is created on the basis of works used in the past). A field 5505 ("CS" field) stores the root directory (corresponding to "CS field" in the example shown in Fig. 42) of manhour set on the basis of automatic manhour setting by the first route, i.e., the standard material (CS)

data file 2804.

At the stage in Fig. 55, the user can confirm manhour data (manhour value and manhour set condition (USE and CS)) automatically set. That is, in the manhour confirmation  
5 processes in step S4004 and S4014 of Fig. 40 are executed by the user through the display shown in Fig. 55. More specifically, in the example shown in Fig. 55, when a work has a value "0" as the "manhour" in the field 5503, it means that no corresponding work is registered in either the  
10 standard material data file 2804 or operation pattern data file 2806.

In step S4004, when the manhour in the window shown in Fig. 55 is "0", to automatically set the manhour by the second route, the user returns to the window shown in Fig. 48  
15 to turn on the check box 4805 and click the OK button 4806.

After the end of automatic manhour setting by the second route, the window shown in Fig. 55 is displayed again, and it is confirmed whether a work having a "manhour" value "0" is present. If a work having a manhour value "0" is  
20 present, processing from step S608 in Fig. 51 is executed. Operations in step S608 and S610 correspond to step S4020 and S4022 in Fig. 40 (third route).

Step S608 in Fig. 51 is executed when the user clicks a "change" button 5506 to change the contents of the elements  
25 (comments, object, and verb) of a work or set the manhour value.

Fig. 56 shows a user interface window for editing a work element. To change a work element, the comment 1, object, comment 1, and verb are corrected in fields 5601 to 5605. To reflect the correction to the setting file 3601, the button 5605 is clicked. To edit the next work element, a button 5606 is clicked.

To edit element works in units of genres, a user interface window shown in Fig. 57 is displayed.

<Operation Analysis>

10 As described above, when the manhour can be determined neither by the first route nor by the second route, the contents of each work are analyzed to determine the manhour using the third route. The control procedure shown in the flow chart of Fig. 51 is used for operation analysis in the  
15 third route.

To analyze a unit work, the user double-clicks on the name of a work to be analyzed in the window shown in Fig. 56. Then, step S610 is executed, and a user interface window shown in Fig. 58 is displayed.

20 In the user interface window shown in Fig. 58, the user inputs a target operation content to a field 5801 and a WF (Work Factor symbol) to a field 5802. A field 5803 stores the directory of a set condition.

In the example shown in Fig. 58, the operation of a  
25 work

"set main body to predetermined position"

is analyzed, and the manhour is calculated. The analysis contents and set conditions obtained by analysis are stored in the set condition field 5803 as a directory including the data.

5 More specifically, for the analysis operation, a WF must be set for a work "set main body to a predetermined position". To do this, the field 5802 is double-clicked.

The WF is a known Work Factor symbol. In the standard manhour setting system 2801 of this embodiment, a  
10 characteristic user interface window as shown in Fig. 59 is prepared to input the WF. In this embodiment, 17 WFs are prepared, as shown in Fig. 59. Since the user understands the operation content "set main body to predetermined position", he/she knows that this operation corresponds to  
15 "pickup" (WF = PU). Hence, the user would check a first button (PU) 5901 and click a "select" button 5902.

In accordance with selection of a button corresponding to a WF in Fig. 59, a user interface window shown in Fig. 60 or 61 is displayed. Of the 17 WFs shown in Fig. 59,

20 PU, GET, ASY, MA, DSY, R, and Ri are WFs to be classified into a "table" type and can be set in the user interface window as shown in Fig. 60. In addition,

UMAC, MP, BODY, SUSD, TURN, STEP, and UMAN  
25 are WFs to be classified into a "formula" type and can be analyzed in the user interface window as shown in Fig. 61.

Furthermore,

M, TD, and WALK

are WFs to be classified into a "table/formula" type and can  
be analyzed in the above-described user interface windows  
5 as shown in Figs. 60 and 61.

The analysis setting user interface window for a  
table-type WF will be described with reference to Fig. 60  
while exemplifying "pickup" (= PU).

Each operation is analyzed by a condition related to  
10 the operation and a threshold value used to determine whether  
the condition is satisfied. For the "pickup" operation of  
the example shown in Fig. 60, five (six at maximum in  
accordance with the display window size) conditions, "moving  
distance", "grip type", "pre-positioning", "main size", and  
15 "weight", are preset.

Six threshold values can be set for condition  
determination in accordance with the limited display window.  
In the example shown in Fig. 60, threshold values "-10 cm",  
"+10 cm", and ">5 cm" are prepared for "moving distance".  
20 Condition values are also preset for the remaining conditions,  
i.e., "grip type", "pre-positioning", "main size", and  
"weight". These condition and condition values (threshold  
values) are displayed when a "default value" button is  
clicked. For each condition, the user selects a condition  
25 value that is suggested to be most appropriate. In the  
example shown in Fig. 60, the user selects

" +10 cm" for "moving distance",  
"Qr-3" for "grip type",  
"NO" for "pre-positioning",  
"-10 mm" for "main size", and  
5 "<3 kg" for "weight"

On the basis of the selection, the user would click on a  
"select" button 6001.

For the operation "set main body to predetermined  
position", which is to be analyzed by the user, since the  
10 user himself/herself selects "PU", the system side knows that  
the WF is of the table type, and analysis by a formula is  
unnecessary. Hence, to indicate that the user cannot operate,  
the icon of a "formula" button 6003 is displayed in a light  
color.

15 When the user clicks on the "set" button 6001, the  
system calculates the manhour (time) for each condition. For  
example, for the condition value "+10 cm" for the condition  
"moving distance", the moving speed of the worker is known,  
and time t1 required for movement by 10 cm is set for the  
20 condition "moving distance". In a similar way, for the  
remaining conditions "grip type", "pre-positioning", "main  
size", and "weight" as well, manhour times t2, t3, t4, and  
t5 are calculated, respectively, and the sum of times t1 to  
t5 is stored in a field 5804 as a manhour. In addition, a  
25 directory for storing the conditions and contents of  
condition values set in Fig. 60 is stored and displayed in

the set condition field 5802 shown in Fig. 58.

Fig. 61 shows analysis definition for a formula-type WF using an example "TURN" ("change direction of body"). More specifically, when time (i.e., unit time) necessary for one  
5 cycle of the operation "change direction of body" is "10", a manhour for the operation "change direction of body" is  
generally represented by

$$10*m$$

where m is a variable representing the "number of times of  
10 operation of changing direction". In this system, a manhour formula "10\*m" is set for TURN ("change direction of body") as a default value. Hence, referring to Fig. 61, the formula "10\*m" is displayed in a field 6101, the variable name "the number of times of operation of changing direction" is  
15 displayed in a field 6102, and the unit of the variable, "times", is displayed in a field 6104. The user inputs the value of "times m" in a field 6103.

On the basis of the selection, when the user clicks on a "set" button 6105, the manhour value is calculated,  
20 displayed in the manhour field 5804 in Fig. 58, and stored in the memory.

The work procedures of work analysis and manhour determination according to the third route have been described above.

25 <Log of Change in Manhour>... Standard Manhour Setting System

Starting from the dialog shown in Fig. 55, when the

manhour set condition is changed, and the "change" button 5506 is clicked, the manhour value may change. The standard manhour setting system 2801 monitors whether the manhour value changes using click on the "change" button 5508 as a  
5 trigger.

When a change in manhour is detected, a user interface window shown in Fig. 62 is displayed to allow the user to input the change reason for the manhour. In the example shown in Fig. 62, a field 6201 contains "10" and indicates that  
10 the manhour change amount is "10". A field 6202 has a USE value "0" and indicates that the work data is still unused. The change reason for the manhour is input to a field 6204. In the example shown in Fig. 62, the change reason is "new setting" because a work is newly registered.

15 The reason code in a field 6203 is provided in a one-to-one correspondence with the change reason. When a new change reason occurs for a work, a reason code with an arbitrary code can be assigned to the change reason. However, to ensure integrity in the entire system, the reason code  
20 to be set is preferably determined in advance.

To display reasons for change in previous setting in the field 6204 in scroll, the user clicks on a button 6206.

The change reason code set in the user interface window shown in Fig. 62 is displayed together with various kinds  
25 of information set for the work. For example, in the display window shown in Fig. 55, the reason code is displayed in a

"correction" field 5507 (value "1").

This standard manhour setting system 2801 can hold the log of five changes (five or more if the memory allows) for one work. To confirm the log of change reasons, the column  
5 of the "correction" field 5507 of the work is double-clicked. Upon clicking, a change log correction window shown in Fig. 63 is displayed. The change reason is displayed in a field 6301, and preceding and succeeding manhour values are displayed in a field 6302. In the example shown in Fig. 63,  
10 the work "electrical check" has only one change reason. However, when a plurality of change reasons are present, five change reasons are displayed at maximum while being stacked on the lower side.

#### <Work Assignment System>

15 As shown in Fig. 28, the work standard creation system 2800 creates work standard data containing no manhour data, and the standard manhour setting system 2801 creates the manhour setting file 3601 from the work standard data.

As shown in Fig. 64, the work assignment system 2802  
20 downloads (loads data) the contents of the manhour setting file 3601 and creates a composition table file 6400. The work assignment system 2802 also determines the range of composition in the loaded manhour setting data, composes works within that range in accordance with a predetermined  
25 purpose, corrects the composition, and outputs the composition. In other words, it may safely be said that the

work standard creation system 2800 and standard manhour setting system 2801 exist such that the work assignment system 2802 can

- automatically execute composition,
- 5 · allow the user to easily grasp the composition result,
- easily correct the composition contents, and -
- do composition matching the set purpose.

Fig. 65 illustrates inputs to the work assignment system 2802 and outputs from the work assignment system 2802.

10 Referring to Fig. 65, the work assignment system 2802 receives the range to be composed as range data 6502. Work data downloaded in accordance with this range is used for the composing operation. Also, division condition data 6503 for division to stations is input as a condition for  
15 composition.

Composition here means that a plurality of works in an order defined by the work standard creation system 2800 are distributed to a plurality of "stations" in accordance with the order of works (including a case wherein the order  
20 is changed by the work assignment system 2802).

A station means a physical station or simply indicates a plurality of work groups put together in terms of concept. Each station is assigned a specific operator. In this assignment, the work assignment system 2802 assigns a  
25 specific operator on the basis of the information of each operator (experience time or the degree of skill for a work),

which is stored in an operator database 6501.

The work assignment system 2802 outputs a simple division window display output 6504 or window display output 6505 (considering the parallel operation of works) to the display unit such that the user can easily confirm the composition result. The composition data can also be output in the EXCEL format as an example of a general document data format.

The work assignment system 2802 provides two division methods as composition methods. As one method, works are simply divided to stations. As the other method, works are divided to stations in consideration of the parallel operation of the works (to be referred to as "parallel division" hereinafter for the descriptive convenience). For either division method, work data download from the standard manhour setting system 2801 to the work assignment system 2802 is necessary.

Fig. 67 shows an example in which some works related to the assembly work of a model "GP55" are loaded to the work assignment system 2802 and displayed on the screen of the display unit. Referring to Fig. 67, "standard No" represents the work order defined by the work standard creation system 2800 and edited or corrected by the standard manhour setting system 2801. In other words, the work assignment system 2802 initially recognizes the order of work data in the manhour setting file 3601 of the standard manhour

setting system 2801 as the work order in the work assignment system 2802. For data in the range of the loaded data (or the range designated by the work assignment system 2802), simple division or parallel division is executed.

5           In the example shown in Fig. 67, the assembly work of one unit of model "GP55" comprises seven (or more) works

- NO. 1: stick handy cut tape
- NO. 2: set labels on main body
- NO. 3: Weiman removal
- 10 · NO. 4: assemble outer case
- NO. 5: fit top pad
- NO. 6: stick large-side order label

The manhour of these works is

$$134 + 550 + 270 + 365 + 268 + 117 = 1704 \text{ RU}$$

15   In this case, 1 RU is 1/1000 min.

<Simple Division>... Work Assignment System

Generally, letting WF (unit: RU) be the total manhour in the composition, U be the number of units (the number of products) to be produced by one crew as a set of a plurality  
20 of operators per day, H (unit: RU) be the operation time of one crew (a set of a plurality of operators) per day, and E be the target composition efficiency (i.e., expected composition efficiency), the number of stations  $N_{ST}$  to be divided is given by

25           
$$N_{ST} = (U \times WF) / (H \times E) \quad \dots (1)$$

That is, when  $N_{ST}$  stations are prepared, the above object can

be achieved. In this setting, the time (i.e., pitch time  $T_p$ ) required for work in each station is given by

$$T_p = H/U \quad \dots (2)$$

In other words, the total manhour of works assigned to one station by simple division is assigned such that it almost matches the pitch time  $T_p$  in average. In the example shown in Fig. 66,

$$t_1, t_2, \dots, t_{n-1}, t_n \doteq T_p \quad \dots (3)$$

Fig. 68 shows a display window in which the works shown in Fig. 67 are divided to plurality of stations, and the work contents of station 1 (St1) and station 2 (St2) are displayed. More specifically, of the seven or more works shown in Fig. 67, works Nos. 1 to 3 are assigned to station 1 (St1) and works Nos. 4 to 6 are assigned to station 2 (St2). In the example shown in Fig. 68, the total manhour in station 1 (St1) is 954 RU, and that in station 2 (St2) is 750 RU. The total manhours "945 RU" and "750 RU" should fall within the pitch time  $T_p$ .

However, in an actual production workshop, composition based on the theory may lower the efficiency. As a measure against this, the work assignment system 2802 prepares a means for easily correcting/changing the contents of composition. The correction/change means is shown in Fig. 69.

Fig. 69 shows a user interface window as the correction/change means displayed on the display screen of

the display unit of the work assignment system 2802. More specifically, a bar graph 6901 represents the manhours (RU) assigned to the stations as a result of simple division. Reference numerals 6902 and 6903 denote contents of works assigned to the respective stations, which correspond to the graph 6901.

Referring to Fig. 69, the bar representing the manhour of the station St1 matches the pitch time  $T_p$ , the bars for the stations St2 and St3 are shorter than the pitch time  $T_p$ , and the bar for a station St4 exceeds the pitch time  $T_p$ .

A certain user may average the variation in manhour between the stations by exchanging the works between the stations. In addition, a certain user may empirically know that the efficiency can be improved by moving a specific work to another station although it increases the variation in manhour.

To cope with this, in the work assignment system 2802, a work in the station St1 and a work in the station St2 shown in the table 6902 can be exchanged. When exchange is actually done, the variation result of the total manhour in each station in accordance with the exchange is reflected to the bar graph 6901. In other words, the process change result can be visually confirmed on the bar graph.

For correction or editing in the work assignment system 2802, not only exchange of two works between different stations but also a change in work order in a single station,

integration editing for integrating two works to one work,  
and editing for dividing one work into two works are prepared.

#### <Parallel Division>... Work Assignment System

In the simple division, works are divided to a  
5 plurality of stations simply in accordance with the work  
order defined by the work standard creation system 2800 or  
standard manhour setting system 2801. This simple division  
does not consider that there are some works that can be  
operated in parallel. Parallel division is division that  
10 takes the parallel operation of works into consideration.

Fig. 70 shows a user interface window for defining the  
parallel operability of works. For the descriptive  
convenience, the example shown in Fig. 70 assumes an assembly  
procedure for a total of 14 works with numbers S (start) to  
15 13. Assume that the names, process number, and manhours of  
all works as shown in Fig. 67 are displayed on the display  
screen of the display unit for user confirmation.

The user defines the parallel operation of works, which  
is known based on the experience of himself/herself, using  
20 work icons and link lines for connecting the work icons, as  
shown in Fig. 70, while confirming the order of works on the  
table as shown in Fig. 67. In the example shown in Fig. 70,  
a work icon is symbolized by a circle and a work number in  
the circle.

25 In the example shown in Fig. 70, for example, since  
works 1, 11, and 3 are linked to work S and have no priority

therebetween. Since work 4 linked to start work S must be executed subsequently after work 3 linked to start work S, work 4 cannot be handled equivalently to works 1, 3, and 11.

Even when the order of works 1, 3, and 11 which are  
5 parallel to each other and have no priority therebetween is changed, no problem is posed. This means that when parallel operation is taken into consideration, a plurality of composition plans are available. The work assignment system 2802 proposes composition plan 1, composition plan 2,... and  
10 displays them, as shown in Fig. 71.

In this system, to present a plurality of composition plans, a parallel work "group" designation function as shown in Figs. 92 and 93 is set.

Group designation of works means that the same group  
15 code is given to a plurality of works to assign them to a single station. The group designation function is provided to designate works requiring the same tools to the same group or works using components on a single attachment surface to the same group to suppress the purchase cost for expensive  
20 tools, or designate works to the same group in order to put assembly works together to effectively use the machine manhour time for other works such that works having the same group code are prevented from being assigned to different stations.

25 Conventionally, the priority of assignment based on such a condition is processed by logic (rule or the like).

However, since designating works using the same tools to the same group may be inconsistent to designating works using components on a single attachment surface to the same group, unique determination may result in an assignment error. In this system, a person experienced in work assignment can manually give a group code to works to be assigned to a single station before execution of automatic composition.

However, group designation that impedes assignment based on the priority table is not allowed, as shown in Fig. 94.

As shown in Fig. 92, when works 2 and 3 are designated to a group, works 2 and 3 are assigned to a single station (composition plan 1 in Fig. 71).

On the other hand, as shown in Fig. 93, when works 2 and 8 are designated to a group, works 2 and 8 are assigned to a single station (composition plan 2 in Fig. 71).

As shown in Fig. 94, group 1 cannot be designated because work 8 outside the group is inserted between works 2 and 12. This is because work 8 must be executed after work 2 and before work 12 and cannot be executed when work 8 is assigned to a station different from that for works 2 and 12. To designate works 2 and 12 to the same group, work 8 inserted therebetween must also be designated to the same group.

As a result of such composition, according to composition plan 1, works Nos. 1, 2, and 3 are assigned to

station 1 (St1), and works Nos. 4, 5, and 6 are assigned to station 2 (St2). On the other hand, according to composition plan 2, works Nos. 1, 2, and 8 are assigned to station 1 (St1), and works Nos. 3, 4, and 5 are assigned to station 2 (St2).

5           A user interface as a composition editing means as in simple composition as shown in Fig. 72 is prepared for each of the composition plans composed by parallel division.

Fig. 72 shows a user interface for composition plan 1, and Fig. 73 shows a user interface for composition plan 2.

#### 10   <Details of Control Procedure>... Work Assignment System

          The work assignment system 2802 prepares two load sources of work data to be composed, i.e., the manhour setting file 3601 (standard manhour setting system 2801 side) and the composition table file 6400 (work assignment system 2802 side), as shown in Fig. 64. More specifically, when the work  
15           assignment system 2802 is activated, and the "load new file (N)" menu of the file menu is selected, data can be loaded from the manhour setting file 3601. When the "open (O)" menu of the file menu is selected, a target work file can be opened  
20           from the composition table file 6400.

Fig. 74 shows a user interface window for a data load when the "open new file (N)" menu is selected.

          In this work assignment system 2802 as well, a set of work data linked by directories having a hierarchical  
25           relationship

genre → representative model → target model →